

Your name:

Your session number:

1. In this exercise, we examine in detail how an instruction is executed in a single-cycle datapath. Problems in this exercise refer to a clock cycle in which the processor fetches the following instruction word: 0x00c6aa23.

1.1 what's the assembly instruction for 0x00c6aa23? (12 points)

Instruction	Format	funct7	rs2	rs1	funct3	rd	opcode
add (add)	R	0000000	reg	reg	000	reg	0110011
sub (sub)	R	0100000	reg	reg	000	reg	0110011
Instruction	Format	immediate		rs1	funct3	rd	opcode
addi (add immediate)	I	constant		reg	000	reg	0010011
lw (load word)	I	address		reg	010	reg	0000011
Instruction	Format	immed-iate	rs2	rs1	funct3	immed-iate	opcode
sw (store word)	S	address	reg	reg	010	address	0100011

FIGURE 2.5 RISC-V instruction encoding. In the table above, “reg” means a register number between 0 and 31 and “address” means a 12-bit address or constant. The funct3 and funct7 fields act as additional opcode fields.

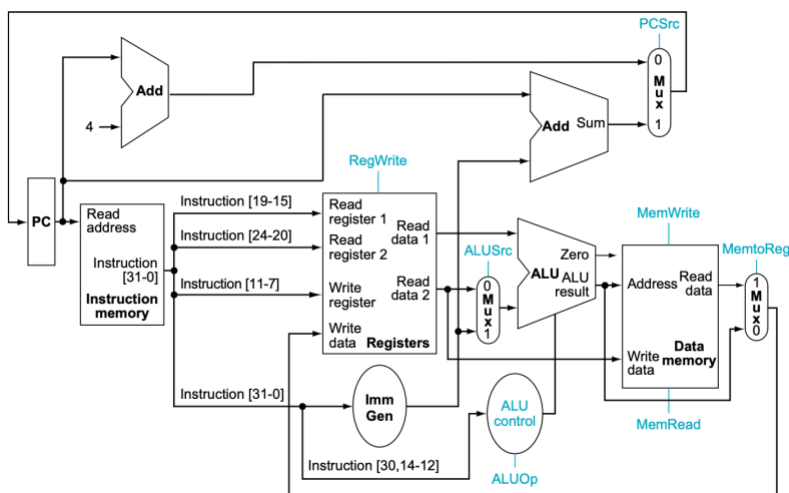
1.2 What are the values of the ALU control unit's inputs for this instruction? (10 point)

ALUOp	ALU control line

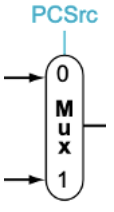
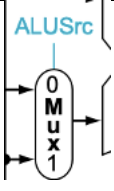
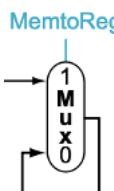
Instructions	ALUOp
<u>lw</u>	00
<u>sw</u>	00
<u>beq</u>	01
R-type	10

ALU control	Function
0000	AND
0001	OR
0010	add
0110	subtract

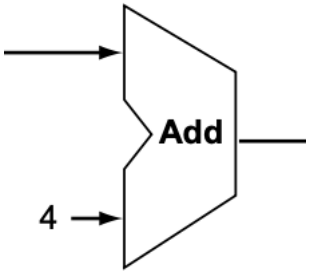
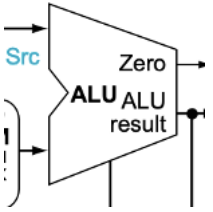
1.3 What is the new PC address after this instruction is executed (assume current is PC)? **Highlight the path through which this value is determined.** (10 points)

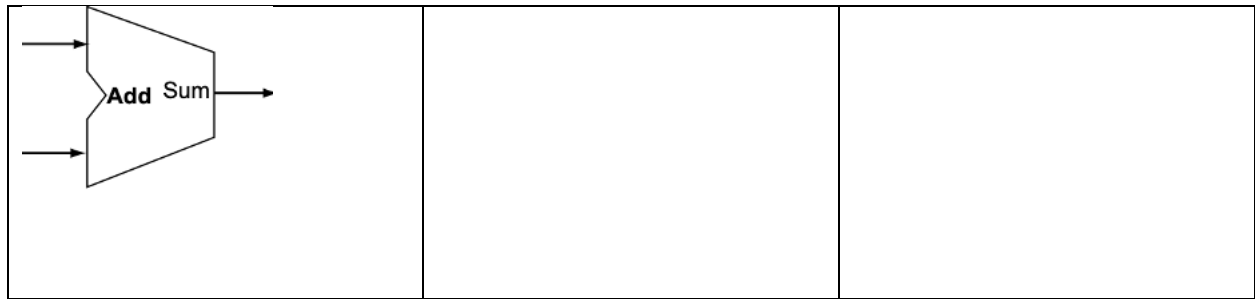


1.4 For each mux, show the values of its inputs and outputs during the execution of this instruction. List values that are register outputs at Reg [xn]. (24 points)

MUX	Mux Value	Output value
		
		
		

1.5 What are the input values for the ALU and the two add units? (24 points)

ALU		
		
		



1.6 What are the values of all inputs for the registers unit? (20 points)

Read register 1 =

Read register 2 =

Write register = (1/0)

Write data = (1/0)

RegWrite = (1/0)